Tour of Smart Grid Projects and State Policies

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Regulatory Assistance Project

- Nonprofit organization founded in 1992 by experienced energy regulators
- Advises policymakers on economically and environmentally sustainable policies in the regulated energy sectors
- Funded by U.S. DOE & EPA, the Energy Foundation, the World Bank, Asian Development Bank, and other foundations
- We have worked in 40+ states and 16 nations

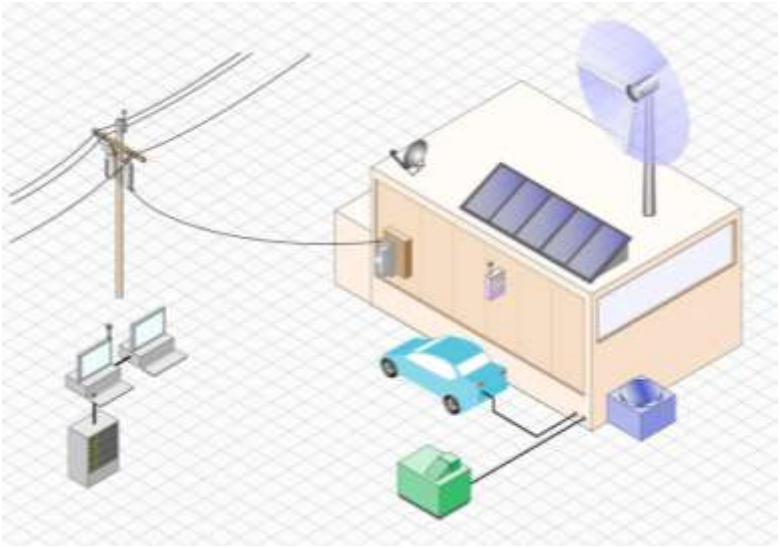
Getting Smart

- Advanced metering infrastructure (AMI – smart meters and 2-way communication) may be a 1st step, providing new capabilities such as:

  - Time-varying pricing options coupled with enabling technology like smart communicating thermostats
  - Useful usage information for consumers and CSRs
  - Improved outage detection and response
  - Right sizing of distribution assets

From Smart to Smarter

- "Smart Grid" continuing to evolve
  - Demos and rollout of pieces
  - Fully integrated projects with these features are just starting
    - Real-time communication
    - Active interaction with loads
    - Distribution system management
    - Optimized integration of distributed generation and storage



EPRI graphic

SELECTED PROJECTS IN THE U.S.

California

Southern California Edison – Edison SmartConnect™		
Project description	AMI with 2-way LAN/WAN; home area network (HAN) interface for household devices to communicate with meter; programmable communicating thermostats (PCTs); near real-time energy usage information; remote connect/disconnect; peak time rebate (PTR) and critical peak pricing (CPP) for residential and business customers	
Number of meters	Electric – 5.3 million*	Gas utility may connect to AMI
Costs and benefits	Cost - $1.63 billion	Benefit/cost - 1.06
Deployment	2008-2012	
Planned enhancements	Customer control of HAN; load control programs through PCTs; ARRA proposals include demos of fully-functioning smart grid from a single substation and 15 MW of compressed air storage	

*California IOU customers >200 kW already have smart meters.

California

- Transmission level
  - 19 Phasor Measurement Units
    - Real-time grid monitoring and black-start capabilities
  - 2 static VAR compensators
  - 28 Centralized Remedial Distribution Action Schemes using high-speed fiber/microwave communications
  - Advanced conductors
- Distribution level
  - Automating >500 substations, 1,600 circuits, 4,000 switches
  - 10,000 automated capacitor controllers
  - Condition-based monitoring
  - Fault current-limiting technology

Colorado

Xcel Energy's Smart Grid City - Boulder*

- Incorporates entire energy pathway, from generation to customer
- High-speed, near real-time, two-way communications
- Sensors, circuit breakers and reclosers at substations, transformers for rapid diagnosis and corrections
- Dispatched distributed generation and energy storage
- 100 miles of fiber installed
- Two-way meters for 25,000 residential and 300 C&I accounts
- Monitoring 3,200 transformers and 5,200 network elements
- Web portal and in-home devices offered to customers Q2 2009
- New pilot pricing tariffs planned for Q1 2010

*Source: Ethnie Groves, Xcel Energy

Texas

CenterPoint Energy - Houston		
Project description	AMI with two-way network (WiMax radios); remote connect/ disconnect; consumer education; home monitors for low-income	
Number of meters	2.4 million	
Costs and benefits	Capital cost - $639.6 million	Est. savings and benefits - $120.6 million during 12-year surcharge period
Deployment	2009 through 2014	
Planned enhancements	ARRA funding proposal may include remote control switches, a Distribution Management System to enable management and control of microgrids and integration of wind and solar, fault location characterization software, predictive failure analysis software, and PHEV demo	

Sources: Filings in TPUC Docket No. 35639; *Smart Grid Today*, 4/27/09; CenterPoint filing in Project No. 36674.

Multiple States

American Electric Power – *gridSMART*	
South Bend, Indiana, Pilot *(2008-09; $7 million)*	10,000 advanced meters; customer access to prior day hourly data; A/C load control; TOU rate option; remote connect/disconnect; 6-10 MW/yr of utility-scale battery storage; PHEV charging, dist. mgt. system on 2% of circuits (reconfiguration/optimization, real-time monitoring and diagnostics, fault location identification)
Texas	Installing 1 million smart meters over next several years
Planned enhancements	Smart meters to all 5 million customers by 2015; microgrids; 25 MW of energy storage by 2010; 1,000 MW of demand reduction from efficiency and DR by 2012
Ohio substation pilot	Demo of high-speed, IP-based communications to connect three substations using high-voltage BPL (USDOE funding); among applications supported are protective relaying, SCADA expansion, remote station surveillance and advanced sensing

Multiple States

- AEP gridSMART Ohio *(Case Nos. 08-917-EL-SSO; 08-918-EL-SSO)*
  - Three-year pilot (2009-2011) with three main components: AMI and HAN for 110,000 meters and distribution automation on 90 circuits
    - PCT and load control switch for customers with central A/C
  - Real-time information to customer and company on usage and loads
  - Distribution automation (implemented in 2011) for real-time control and monitoring of electrical equipment such as capacitor banks, voltage regulators, reclosers and automated line switches
  - Projected cost is $109 million over 3-year Electric Security Plan period
  - Commission approved a rider to recover costs
    - Required AEP to seek federal stimulus funds for 50% of project cost
    - Rider initially set for 2009 ($33.6 million)
    - Subject to annual true-up and reconciliation based on prudently incurred costs

Multiple States

Duke Energy – *Utility of the Future*	
Project description	•South Charlotte – 14,700 smart meters, power-line carrier (PLC) •Upstate S. Carolina – >7,000 smart meters, PLC & radio freq. •Cincinnati, Ohio – 50,000 smart meters, PLC •36 energy management, storage and control units installed
Planned enhancements	•Microgrid project in South Charlotte •146,000 more smart meters in Cincinnati in 2009, ramping up to 10,000 meters/day in Ohio pending regulatory approval •Indiana *(Docket No. 43501)* – Settlement agreement filed 6/4/09. Smart meters with PLC and wireless communications for all 800,000 Duke accounts in the state, remote connect/disconnect, IP-based distribution system communications (e.g., line sensors, capacitor banks), distribution automation including circuit breakers and electronic reclosers, switched capacitor banks and voltage regulators, enhanced sectionalization and self-healing technology, distributed renewable demonstration project

Sources: David Mohler, Duke Energy, Grid Week 2008 presentation (9/08); Duke filings in Indiana Docket No. 43501.

Microgrids

- ATK Launch Systems, Utah
  - Demonstrate benefits of integrating diverse, distributed renewable energy technologies (2.6 MW) and intelligent automation system w/2-way communication

  - Designed for verifiable, on-demand reduction of at least 15% of substation load with no disruption of facility operations; $800,000 annual savings
- Fort ZED, City of Fort Collins
  - Zero Energy District - Annually creates as much energy locally as it uses
  - Aggregating 5 MW of distributed energy resources
  - 20% peak load reduction on two feeders by 2011
  - $4.84 million ARRA award

Sources: Presentations by Roger Weir and Mike Freeman, Renewable and Distributed Systems Integration Peer Review, 10/29/08; Brendle Group; USDOE announcement, 7/09

One of the Many Proposed ARRA Projects

- **eEnergy Vermont** – Utility consortium proposing wireless broadband from substations to devices and for data backhaul, 300,000+ smart meters, meter data management system, information technology integration, dynamic pricing trials (PTR), in-home displays, smart thermostats, smart appliances, usage data on Web, grid automation (fiber, sensors, breakers, reclosers) integrated with AMI and outage management system, remote connect/disconnect, dynamic control of water heating, conservation voltage reduction
  - Cost estimate: $138 million
  - 20-year NPV benefit: $114 to $127 million (O&M, peak demand, power quality/reliability)

Source: eEnergy Vermont, Smart Grid Investment Grant Application, 8/6/09

A COUPLE OF PROJECTS OUTSIDE THE U.S.

European Union

Enel SpA - Italy		
Project description	32 million smart meters installed from 2000 to 2005; real-time display of home energy usage; pricing options and participation in energy markets; automatic management of the grid in case of outage; monitoring of status of network components; >100,000 substations remotely controlled; automated fault clearing; mobile applications for field crews	
Costs and benefits	Cost - €2.1 billion	Projected annual savings - €500 million
Planned enhancements	More fault detectors, new voltage and current outdoor sensors, distributed generation protection, enable active participation of small and medium customers in power market. Enel coordinates ADDRESS, a consortium of 11 EU countries developing large-scale interactive distribution energy networks.	

Sources: "Echelon teams with T-Mobile for cell-based AMI," *Smart Grid Today*, 4/23/09;
Enel Spa presentations at Grid Week 2008 and Brussels, 3/19/09

European Union

EDF – France, Italy, Germany, UK		
Project description	2010: 1% pilot (300,000 meters, 7,000 concentrators) to test information system and deployment process and validate business case; installing advanced digital controls for distribution automation at substations 2012-2016 – 35 million meters; 700,000 collectors	
Costs and benefits	Cost - $6.4 billion (est.)	Est. yearly savings - ~$650M
Smart grid demos	PREMIO - Distributed energy resources, renewable resources, energy efficiency and demand response FENIX – Aggregate distributed energy resources to create a large-scale virtual power plant	

Source: Richard Schomberg - EDF VP Research North America, GridWeek 2008

STATE POLICIES ON SMART GRID

Some Smart Grid Drivers

- Enabling higher levels of efficiency & demand response (and better EM&V), distributed and renewable resources
- Deferral of costly new power plants and power lines
- Getting ahead of mass use of PHEVs – automate off-peak charging and V2G (on-peak discharging)
- Giving customers more control over energy bills and letting them participate in electricity market
- End-to-end system integration and system efficiencies
- Calls for higher reliability
- Stimulus funding

Barriers to Smart Grid

- New technology risk
- Lack of standards
- Cost recovery risk
- Making the business case, esp. benefits beyond operational savings
- Utility financial disincentives
  - Reduced sales from Smart Grid-enabled customer-side resources
- Regulatory obstacles to third-party participation
- Cyber-security issues
- Concerns about cost impacts on low-income and elderly
- Perception that smart grid is technology company hype and utilities wanting to rate-base new assets
- Lack of vision – Getting stuck on customer end and not seeing the whole picture

Policies in Selected States

- California
- Illinois
- Massachusetts
- Ohio
- Pennsylvania
- Texas
- *Additional slides:* Other states served by Oregon utilities

California

California activities at a glance	
Rulemaking on policies and practices for AMI, demand response, and dynamic pricing *(R.02-06-001)*	• Established minimum functionality criteria for AMI eligible for ratepayer funding – for example: Implementation of price responsive tariffs Collection of hourly usage data Capable of communicating with load control technology Compatible with applications that improve system operating efficiency and service reliability (e.g., remote meter reading, outage management, and reduced theft and diversion • Adopted analysis framework to guide utility AMI business cases • Established Statewide Pricing Pilot to test impact of TOU and CPP tariffs on residential and small commercial customer usage • Adopted demand response program plans for customers >200 kW and annual MW targets for demand response • Vision for pricing options (e.g., residential customers should have a choice of CPP, TOU or flat pricing w/hedge for risk protection)

California

California activities at a glance (cont.)	
California Energy Action Plan	Loading order – Efficiency and demand response first, then renewable resources, then conventional generation and transmission; demand response should meet 5% of system peak demand
Approved AMI business cases with additional smart grid features	Pacific Gas and Electric San Diego Gas and Electric Southern California Edison
Legislation	Under SB 17 (introduced 12/1/08), CPUC would develop requirements for smart grid deployment plans by 7/1/10 consistent with policies in bill; electric companies would submit plans by 7/1/11 for CPUC approval (CPUC can modify requirements for utilities with <100,000 customers)

California

- EISA 2007 *(R.08-12-009; http://docs.cpuc.ca.gov/published/proceedings/R0812009.htm)*
  - Goal is to develop a state-wide Smart Grid vision and consistent framework; two-year process expected
  - Proposed decision issued 7/21/09 on initial issue – processes for reviewing investments by utilities seeking federal recovery funding
    - Reporting – Notice of federal funding application and results, copies of quarterly status reports to DOE for funded projects, other reports to DOE
    - Utilities may establish accounts to track costs of projects
    - Showing of cost and benefits in a Smart Grid application approved by USDOE shall have a rebuttable presumption of accuracy
    - Commission will review whether benefits to ratepayers exceed costs they would incur for residual financing, whether project would create jobs, and consistency with Energy Action Plan and relevant energy policies*

*Demonstrates in aggregate net benefits in at least one of these areas: energy conservation/ efficiency, demand response, renewable energy, GHG emissions and system reliability.

Illinois

Illinois activities at a glance	
Legislation *(SB 1592, 8/07)*	Directs utilities to reduce peak demand beginning 6/1/08 by 0.1% over prior year, for 10 years, through cost-effective demand response
Commission Smart Grid orders *(Docket Nos. 07-0566 and 07-0585 through 07-0590)*	***Com Ed System Modernization Projects*** - Approved 200,000-meter pilot with two-way communication starting 4th quarter 2009; includes assessment of pilot plus B/C analysis for full-scale deployment (4 million meters); Com Ed will submit smart grid plan late 2010/early 2011 with possible full-scale rollout in 2013; established foundational policies and Statewide Smart Grid Collaborative ***Ameren Illinois Utilities*** – Approved pilot instead of request for full smart grid deployment; statewide collaborative will recommend steps forward

Illinois

- Statewide Smart Grid Collaborative includes utilities, Commission staff, consumers and other stakeholders
  - Develop strategic plan to guide SG deployment, including goals, timetables, evaluation criteria and functionality criteria for SG technologies
  - Recommend policies to guide SG deployment
  - Analyze benefits and costs for utilities and consumers
  - Report to be completed by 10/1/10
  - Subsequent docket to consider report, outstanding issues

Illinois

- Foundational policies to be considered by Collaborative
  - **Definition of a smart grid** and its functions
  - **Principles** for guiding smart grid planning and deployment
  - **Consumer education** and dissemination of information about smart grid technologies, demand response programs and alternative rate structures
  - **Pricing**, including implications of smart grid technology for rate design, consumer protection and customer choice; mechanisms to flow through to customers any utility smart grid revenues; and adoption of new demand response programs
  - **Benefit/cost evaluation**
  - **Effect of state statutes on smart grid planning and implementation** – Goals for renewable resources, demand response and energy efficiency
  - **Interconnection standards** for 3rd party equipment
  - **Open architecture and interoperability standards** for connectivity to RTO/ISO
  - **Data** collection, storage, management, security and availability to 3rd parties
  - **Access by electricity market participants** to smart grid functionalities

Massachusetts

Massachusetts activities at a glance	
Legislation *(Green Communities Act Chapter 169, 2008)*	Section 85 required each EDC to file a proposed plan with the DPU by 4/1/09 to establish a smart grid pilot program • "[A]dvanced technology to operate an integrated grid network communication system in a limited geographic area" • At a minimum, smart meters that provide real time measurement and communication of energy consumption, automated load management systems, and remote status detection and operation of distribution system equipment • Must include pilot TOU or hourly pricing - 0.25% of customers • Incremental pilot costs recouped through Basic Service rates
Commission proceedings on Green Communities Act *(Docket Nos. 09-31 to 09-34)*	Fitchburg, NGrid, NStar and Western Massachusetts Electric filed plans

Ohio

Ohio activities at a glance	
Legislation *(SB 221, effective 7/31/08)*	State policy to encourage time-differentiated pricing and AMI; requires EDCs to file Electric Security Plans that may propose a Distribution Infrastructure Modernization Plan with single issue rate-making and incentives including lost revenue and shared savings
Commission rulemaking on SB 221 *(Case No. 08-777-EL-ORD)*	Describes time-differentiated and dynamic pricing options to be offered; requires application for Infrastructure Modernization Plan to describe communication infrastructure, metering, distribution automation, or other applications it supports as well as benefits, costs, performance milestones and metrics
Approved plans *(e.g., AEP, Case Nos. 08-917-EL-SSO, 08-918-EL-SSO)*	Include demand response programs and smart metering pilots and studies; create a collaborative for smart grid deployments, efficiency and demand reduction programs

Pennsylvania

- Act 129 *(66 Pa. C.S. § 2807(f), effective 11/14/08)*
  - Requires electric EDCs with >100,000 customers to file smart meter procurement and installation plans by 8/14/09 for PUC approval
  - Technology must be capable of bidirectional communication and record electricity usage at least hourly; also must provide customers direct information on hourly consumption, enable TOU rates and real time pricing, and effectively support automatic control of consumption by customer or, at customer's request, by the EDC or a third party
  - Default service providers must submit TOU and real-time pricing plans by 1/1/10, or at the end of the applicable rate cap period, whichever is later
  - EDC can recover "all reasonable and prudent costs of providing smart meter technology" via base rates or automatic adjustment clause
  - Requires EDCs to make available to 3rd parties direct meter access and electronic access to meter data, upon customer consent

Pennsylvania

- Commission order on implementation (*Docket No. M-2009-2092655*)
  - Smart meter plan must quantify costs to meet minimum requirements set forth in Act, costs to meet additional functionality requirements in order, and individual incremental costs of each added function, less operating and capital cost savings
  - Additional minimum functionality requirements: remote disconnect/ reconnect, 15-minute interval data (consistent with RTO) delivered daily, data storage capability at meter, open standards and protocols that comply with nationally recognized non-proprietary standards, communication of outages and restorations, monitor and report voltage at each meter, remote reprogramming, communicate outages and restorations, support net metering, upgrade capabilities with technological advances

Texas

Texas activities at a glance	
Legislation *HB 2129, 2005* *HB 3693, 2007*	Required Commission to establish a cost recovery mechanism for utilities that install AMI and report biennially on progress, barriers and recommendations Encourages smart grid networks to be deployed as rapidly as possible; requires utilities to report how they met reductions in annual growth of demand mandated by Efficiency Portfolio Standard
Commission rules on HB 2129 *(P.U.C. Subst. R. 25.130, Project 31418)*	Established AMI deployment plan requirements and expedited process for cost recovery surcharge for deployment meeting minimum functional criteria
Commission investigations *(Projects 32854 and 33874)*	Will accept EPAct 2005 AMI/TOU standard Addressed cost information required for AMI surcharge request and approved McKinsey model for B/C analysis

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ADDITIONAL SLIDES

Other States Served by Oregon Utilities

- Idaho Commission
  - Approved Idaho Power's AMI project *(Case No. IPC-E-08-16, Order No. 30726)*
    - Includes accelerated depreciation of existing metering equipment over the three-year deployment period (2009-2011)
    - Up to $70.9 million in capital costs can be included in base rates as meters go into service; O&M benefits to be included as they occur
    - Operational benefits alone justified investment
      - About $9 million during deployment period
  - EISA 2007 investigation *(Case No. GNR-E-08-04)*
    - Initial comments filed; public workshop May 6th
    - Additional opportunity for written comments

Other States Served by Oregon Utilities

- Utah Commission
  - EISA proceeding in process *(Docket No. 08-999-05)*
  - Declined to adopt EPAct 2005 standards for metering, time-varying rates
    - Directed Rocky Mountain Power to file a report summarizing the results of its survey of utilities with advanced metering, and other studies and data supporting the company's conclusion that it is not cost-effective, for review by DSM advisory group

Other States Served by Oregon Utilities

- Washington Commission
  - Staff proposal filed 7/30/09 in EISA proceeding *(Docket No. U-090222)*
    - Smart Grid Investment Standard
      - Staff recommends further work to consider a rule requiring electric utilities to report on their activity and evaluations regarding smart grid technology
      - Current practices already address other standards
    - Smart Grid Information Standard
      - Current regulations meet some of the standards; question whether additional standards for time-varying pricing make sense absent organized wholesale market

Other States Served by Oregon Utilities

- Wyoming Commission
  - EISA 2007 order issued 7/10/09 *(Docket No. 90000-106-XO-8; http://psc.state.wy.us/htdocs/orders/90000-106-18739.htm)*
    - Declined to adopt smart grid standards
    - Requires annual reports on smart grid technology developments; first report due in a year